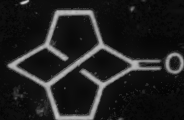


MAY 9, 1983

A1250-1
5/10/83

CHEMICAL & ENGINEERING

NEWS



Twistanone

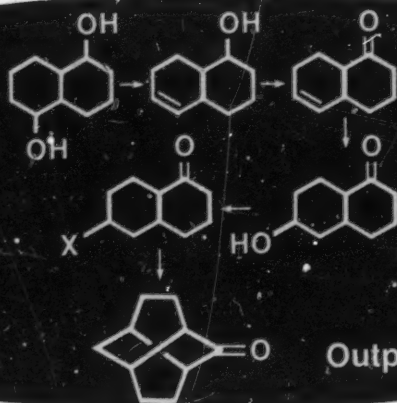
Target

No



structures in
intermediates

Constraints



Output

**COMPUTERS IN
CHEMISTRY—
MANAGING A
REVOLUTION**
PAGE 7

BEST AVAILABLE COPY

0511179C093 9 W AR6119SL 1
CONGRESSIONAL INFO SERV
4520 EAST WEST HWY SUITE 800
SRI ACQUISITIONS
BETHESDA MD 20814

News of the Week

■ Joel H. Hildebrand is dead at age 101. Page 4

■ The Commerce Department would be replaced by a Department of Trade under a new Administration proposal. Page 5

■ Emphasis of man-made fibers R&D will shift to new products and process variants. Page 5

■ Aerosol production in 1982 declined 4.5% from 1981 output, hitting a new low. Page 6

■ Proposed sale of Kuwaiti ammonia to West Germany's Hoechst would be first European chemical market for the Mideast country. Page 6

Letters 2

Editor's Page 3

Concentrates

Business 32

Government 39

Science/Technology 44

The Departments

Books 52

ACS News 55

Awards 63

People 64

Newsclips 72

Special Report

Organic synthesis by computer: one system, displaying graphical images, uses retrosynthetic pathways to identify precursors. Page 22

Business

Sales of C&EN's Second 50 chemical firms, usually resistant to recession, were down 6% in 1982, operating profits, 40%. Page 33

International

Japanese chemical makers are optimistic that the economy will improve and crude oil prices will drop. Page 38

Government

EPA's R&D office suffers from funding cutbacks, lack of direction; CAS may play role in patent office automation. Page 40

Science

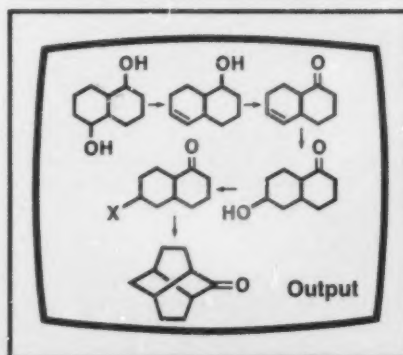
Chemists are using mathematicians' tools such as graph theory and topology to classify molecular structure, properties. Page 45

Science Policy

NAS president Frank Press cites the politicization of science in government, national security issues as prime concerns. Page 49

Education

Blue-ribbon panel on quality of U.S. education blasts mediocrity of secondary school curricula, substandard teaching. Page 50



News Focus

Advent of the computer is changing the practice of chemistry toward a more mathematical basis. Page 7

Sales Down at Medium-Sized Chemical Firms

Second 50 firms recorded combined sales last year down 6%, operating profits off 40%; profitability also dropped sharply

William J. Storck, C&EN New York

The decline that befell the chemical industry in 1982 did not skip over medium-sized chemical producers as such declines often have in the past.

The more specialized companies, with generally higher value-added

products, that make up C&EN's list of Second 50 chemical producers (ranked 51 through 100 in terms of chemical sales) normally find themselves more recession-resistant than the Top 50 producers. And to a certain extent, they are. However, in 1982, though their sales and operating profits were not down so much as those of the Top 50 (C&EN, May 2, page 9), they can take small comfort.

Combined sales for the Second 50 companies were down last year about 6% from 1981 to about \$18.6 billion. Their combined chemical operating profits (for those that reveal such data) were just \$954 million, down

40% from 1981. Based on available data that are comparable year to year, identifiable chemical assets fell 1% from 1981 to \$11.6 billion.

As a result, profitability measures suffered in 1982. Chemical operating profit margins for the group dropped to an average of 7.1% in 1982 from 11.0% the year before, and operating return on assets for chemicals fell to 8.2% from 13.7% in 1981.

Of the 50 companies, 32 recorded sales declines in 1982 from 1981. And of the 39 companies that report operating profits from chemicals, 29 had either declines in chemical profits or their chemical operations showed deficits in 1982.

Second 50 firms performed better than Top 50

There was little to cheer about in the chemical industry last year, but the group of companies that make up the Second 50 chemical producers can say that, as a group, they did fare a little better than the companies that make up the Top 50 list.

In terms of performance, companies making up the Second 50 posted an average chemical sales decline of 7% in 1982 from the year before. Chemical sales at the Top 50 fell 11% from 1981.

The Second 50 group consistently has turned in a better performance than the Top 50, perhaps because the medium-sized producers are not so encumbered with the highly cyclical commodity chemicals that dominate many of the firms' products in the larger group.

However, even the Second 50 were not immune to recession last year. Besides the 7% drop in chemical sales, chemical operating profits fell 40% from the year before.

The smaller firms also were able to

hold their asset base a little better than the larger companies in a year of little capital spending. Identifiable chemical assets for the Second 50 dropped 1% from 1981, whereas at the larger firms the average fell a little more than 2%.

The smaller firms also outperformed the larger in profitability ratios. Chemical operating profit margins for the Second 50 averaged 7.1% in 1982, against a margin of 4.0% for the Top 50.

And operating return on assets for chemicals averaged 8.2% for the Second 50, and 4.6% for the Top 50.

This year, the number of chemical companies on both lists was the same at 23, as some of the companies on the Top 50 were reclassified as diversified. Petroleum companies on the Top 50 list outnumber those on the Second 50 14 to eight. The diversified companies among the Second 50 number 19; only 13 of the Top 50 are classified as diversified or other.

Eight of the Second 50 companies are owned by foreign interests, but just four of the Top 50 fall into this category.

	Second 50	Top 50	Combined 100
Chemical sales, change from 1981	-7%	-11%	-10%
Chemical operating profits, change from 1981	-40	-55	-53
Chemical assets, change from 1981	-1	-2	-2
Chemical operating profit margin, 1982	7.1	4.0	4.4
Return on identifiable chemical assets, 1982	8.2	4.6	5.1
Number of companies on list			
Chemical companies	23	23	46
Petroleum and natural gas producers	8	14	22
Diversified and other	19	13	32
Foreign owned ^a	8	4	12

^a Also included in above categories.

Second 50 chemical producers generally had lower sales in 1982

Rank 1982	Rank 1981 ^a	Company	Chemical sales 1982 (\$ millions)	Change from 1981	Chemical sales as % of total sales	Industry classification	Chemical operating profits ^b	Change from 1981	Chemical operating profits as % of total operating profits	Operating profit margin ^c	Identifi- fiable chemical assets	Chemical assets % of total assets	Operating return on chemical assets ^d
51	59	Esmark ^e	\$630 ^f	-3.0%	18.6%	Food	\$ 23	-37.9%	12.6%	3.7%	\$370	21.0%	6.2%
52	47	Georgia-Pacific	628	-14.9	11.6	Wood products	75	-49.7	31.9	11.9	1025	24.7	7.3
53	52	Borg-Warner	613	-7.7	19.2	Auto equipment	52	-15.4	22.8	8.5	297	17.7	17.5
54	54	Pennwalt	581	-9.4	61.0	Basic chemicals	46	-36.9	61.7	7.9	438	68.2	10.5
55	66	Standard Oil (Ohio)	554	12.8	4.1	Petroleum	-23	def	def	def	534	3.3	def
56	50	Koppers	535 ^f	-21.1	33.8	Diversified	16	-64.1	25.4	2.9	327	29.7	4.7
57	47	Sun Co.	516	-30.8	3.1	Petroleum	na	na	na	na	na	na	na
58	56	Uniroyal	516	-10.0	26.2	Rubber products	42	-46.8	38.1	8.1	425	36.6	9.9
59	64	Witco Chemical	513	0.5	39.3	Specialty chemicals	39	-19.2	34.0	7.5	241	36.4	16.0
60	58	Badische	501	-11.0	100.0	Basic chemicals	-8	def	def	def	483	100.0	def
61	61	Aluminum Co. of America	493 ^f	-5.7	10.7	Nonferrous metals	na	na	na	na	na	na	na
62	62	Kerr-McGee	488	-10.0	12.9	Petroleum	-10	def	def	def	656	18.1	def
63	57	NL Industries	477	-15.6	21.5	Petroleum services	61	-21.4	21.4	12.8	307	13.4	19.9
64	65	Airco	473	-5.4	41.7	Basic chemicals	na	na	na	na	na	na	na
65	66	Cabot ^g	471	-4.1	31.0	Specialty metals	62	-4.7	30.1	13.2	264	20.0	23.5
66	55	El Paso	468	-18.8	10.7	Natural gas	-102	def	def	def	331	7.9	def
67	70	National Starch	467	3.8	67.5	Specialty chemicals	na	na	na	na	na	na	na
68	69	International Flavors	448	-0.7	100.0	Specialty chemicals	104	2.0	100.0	23.2	432	100.0	24.1
69	60	Freeport-McMoran	435	-21.4	58.2	Agricultural chemicals	94	-36.6	130.6	21.6	282	17.0	33.3
70	74	Polysar	432	9.4	100.0	Basic chemicals	na	na	na	na	na	na	na
71	71	Beatrice Foods	419	-6.1	4.6	Food	9	-85.7	1.3	2.1	na	na	na
72	72	Pfizer	391	-7.2	11.3	Drugs	-1	def	def	def	421	11.2	def
73	77	Liquid Air	371	13.4	82.6	Basic chemicals	48	5.1	99.4	12.9	455	84.8	10.5
74	75	Internorth	341	-7.6	8.2	Natural gas	2	-91.1	1.0	0.6	na	na	na
75	—	Henkel	475	nc	100.0	Specialty chemicals	na	na	na	na	na	na	na
76	85	H. B. Fuller ^h	332	0.9	100.0	Specialty chemicals	25	-18.9	100.0	7.5	207	100.0	12.1
77	73	Mississippi Chemical ⁱ	326	-4.6	100.0	Farm cooperative	25	-67.2	100.0	7.7	375	100.0	6.7
78	78	GAF	311	-4.6	49.8	Specialty chemicals	50	-11.5	210.5	16.1	196	41.9	25.5
79	86	Tyler	302	9.0	34.6	Diversified chemicals	12	-49.8	23.0	3.9	162	35.0	7.4
80	83	Rhône-Poulenc	300	0	100.0	Specialty chemicals	na	na	na	na	na	na	na
81	69	Big Three Industries	283	6.9	36.9	Petroleum services	83	1.1	47.5	28.1	489	46.3	16.4
82	93	Houston Natural Gas ^j	278	12.3	8.7	Natural gas	32	17.5	8.5	11.5	398	17.0	8.0
83	91	Petrolite ^k	275	5.6	90.9	Specialty chemicals	48	9.9	91.0	17.5	161	80.3	29.8
84	80	Terra Chemicals	273	-13.9	100.0	Agricultural chemicals	na	na	na	na	na	na	na
85	79	Upjohn	268	-17.3	14.7	Drugs	-35	def	def	def	183	9.1	def
86	84	Vulcan Materials	263	-12.0	36.5	Nonmetallic minerals	44	-37.2	49.5	16.7	na	na	na
87	88	Umhart	253	-6.2	14.8	Machinery	23	-13.4	12.7	9.1	105	11.5	22.0
88	76	American Petrofina	252	-24.9	11.2	Petroleum	-7	def	def	def	207	19.1	def
89	92	Soltex	250	0	100.0	Basic chemicals	na	na	na	na	na	na	na
90	90	SCM ^l	249 ^f	-5.5	13.2	Paint	22	-28.2	26.8	9.0	273	24.3	8.2
91	95	Engelhard	248 ^f	3.4	12.3	Specialty metals	49	4.0	57.2	19.8	238	31.5	20.6
92	—	Chemed	233	-1.3	93.6	Specialty chemicals	32	4.3	91.3	13.5	105	63.3	29.9
93	86	Martin Marietta	222	-19.7	6.3	Aerospace	19	-60.1	11.9	8.6	239	9.3	7.9
94	97	Loctite	216	1.2	100.0	Specialty chemicals	26	99.8	100.0	12.0	200	100.0	13.0
95	96	Baker Industries	210	1.6	100.0	Agricultural chemicals	-9	def	def	def	304	100.0	def
96	98	Stepan Chemical	208	1.4	100.0	Specialty chemicals	13	-16.6	100.0	6.0	163	100.0	7.7
97	—	Ferro	205 ^f	-13.3	34.5	Specialty materials	8	-42.9	22.7	4.1	114	32.7	7.4
98	99	Getty	202	-1.0	1.6	Petroleum	1	-92.9	0.1	0.5	na	na	na
99	100	Agway	194	-3.0	5.1	Farm cooperative	na	na	na	na	na	na	na
100	—	Great Lakes Chemical	168	12.9	100.0	Specialty chemicals	29	4.7	100.0	17.3	202	100.0	14.4

^a Revised. ^b Sales minus administrative expense and cost of selling. ^c Operating profit as a percentage of chemical sales. ^d Operating profit as a percentage of identifiable chemical assets.

^e Fiscal year ended Oct. 31, 1982. ^f Chemical sales include significant amounts of nonchemical products. ^g Fiscal year ended Sept. 30, 1982. ^h Fiscal year ended Nov. 30, 1982. ⁱ Fiscal year ended June 30, 1982. ^j Fiscal year ended July 31, 1982. ^k na = not available. ^l nc = not comparable with previous year's data. ^m def = deficit.

The list of companies ranked for 1982 has changed a little from the 1981 group. Three companies—Nalco Chemical, Merck, and Kaiser Aluminum & Chemical—graduated from the Second 50 to the Top 50 listing of chemical producers in 1982. Meanwhile, Georgia-Pacific and Sun Co., which had been on the Top 50 list in 1981, have fallen back to the Second 50.

One other company, Thiokol, which had been on the Second 50 in previous years, is not on the list for 1982. Thiokol was merged into Morton Norwich during the year, creating Morton-Thiokol. Because of the timing of the merger, total chemical sales figures for the combined company are not available; therefore it was excluded this year. Its sales are undoubtedly high enough to make the Second 50. Next year, when its accounting is resolved, it almost certainly will be back on the list.

There are four new companies included this time that were not on the 1981 list. Henkel is number 75 this year and surely would have qualified in previous years had its chemical sales figures been available.

Chemed, which in previous years had not been included because it was owned largely by W. R. Grace, has broken free of that association and is now ranked 92nd among U.S. chemical producers. Two others—Ferro, ranked 97th, and Great Lakes Chemical, number 100—also are new to the list this year. □

The chemical industry in 1982

The U.S. chemical industry followed the economy downward last year as chemical sales in the U.S. dropped about 10% from 1981 to \$128 billion.

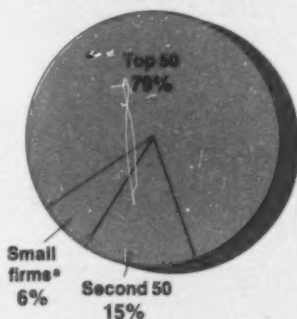
The companies that sold these chemicals include not only C&EN's lists of Top 50 and Second 50 chemical producers but companies that are too small to be included in the listings, and companies that do not report, or inadequately report, their chemical sales. A number of foreign-owned and U.S. companies fall into the last category.

Of the \$128 billion in sales by U.S. companies and by foreign-owned companies in the U.S. last year, the Top 50 accounted for a little more than \$101 billion, or about 79%. The Second 50 companies sold about \$18.6 billion

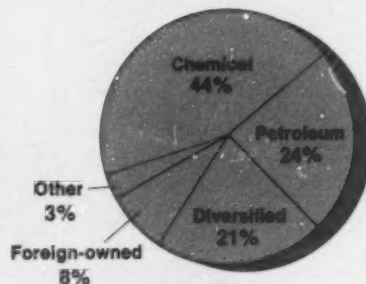
worth of chemicals, or about 15%. The remaining 6% of sales was by firms too small to make the list and companies that do not reveal chemical sales.

By company type, of the \$128 billion in chemical sales, 44% was by chemical companies. Petroleum and natural gas producers accounted for about 24% of chemical sales. And diversified companies made up about 21%. This group includes companies, though not broadly diversified, that have the majority of their sales in operations other than chemicals or petroleum. Foreign-owned companies accounted for about 8% of chemical sales. Companies that did not disclose their chemical sales made up an estimated 3% of the total.

Sales by company size



Sales by company type



Total 1982 U.S. chemical sales = \$128 billion

^a Also includes companies not disclosing chemical sales.

Leaders among the Second 50 in profits, assets, and profitability

Rank	Operating profit (\$ millions)		Operating profit margin ^a		Chemical assets (\$ millions)		Return on chemical assets ^b	
1	International Flavors	\$104	Big Three Industries	28.1%	Georgia-Pacific	\$1025	Freeport-McMoRan	33.3%
2	Freeport-McMoRan	94	International Flavors	23.2	Kerr-McGee	556	Chemed	29.9
3	Big Three Industries	80	Freeport-McMoRan	21.6	Standard Oil (Ohio)	534	Petrolite	29.8
4	Georgia-Pacific	75	Engelhard	19.6	Big Three Industries	489	GAF	25.5
5	Cabot	62	Petrolite	17.5	Eadsche	483	International Minerals	24.1
6	NL Industries	61	Great Lakes Chemical	17.3	Liquid Air	455	Cabot	23.5
7	Borg-Warner	52	Vulcan Materials	16.7	Pennwalt	438	Emhart	22.0
8	GAF	50	GAF	16.1	International Flavors	432	Engelhard	20.6
9	Engelhard	49	Chemed	13.5	Uniroyal	425	NL Industries	19.9
10	Liquid Air	48	Cabot	13.2	Pfizer	421	Borg-Warner	17.5
11	Petrolite	48	Liquid Air	12.9	Houston Natural Gas	398	Big Three Industries	16.4
12	Pennwalt	46	NL Industries	12.8	Mississippi Chemical	375	Witco Chemical	16.0
13	Vulcan Materials	44	Loctite	12.0	Esmark	370	Great Lakes Chemical	14.4
14	Uniroyal	42	Georgia-Pacific	11.9	El Paso	331	Loctite	13.0
15	Witco Chemical	39	Houston Natural Gas	11.5	Koppers	327	H. B. Fuller	12.1

^a Chemical operating profit as a percentage of chemical sales. ^b Chemical operating profit as a percentage of identifiable chemical assets.

Research at EPA: A Crisis of Bad Morale, Unhappy History

Funding cutbacks, lack of permanent director produce drift at agency R&D office; new plan offers some hope, but problems remain

Will Lepkowski, C&EN Washington

Last week the Senate began the process of confirming William D. Ruckelshaus as fifth administrator of the 12-year-old Environmental Protection Agency. Ruckelshaus will have no trouble getting through and his first order of priority will be to repair the agency's poor enforcement image.

But sooner or later he will have to focus on the agency's crippled research and development program, which currently is suffering from

enormous cutbacks and, for more than a year, from no permanent leadership.

The scientific community is concerned. National Academy of Sciences president Frank Press told academy members at their annual meeting a few days ago that EPA "research activities continue to be devastated at a time when more, not less, science is needed for regulatory decision making." Press also criticized the Administration for insisting on ideological "purity" in making appointments to EPA's scientific advisory boards (see page 49).

The Reagan Administration is asking \$208 million for fiscal 1984 for EPA's research and development effort, down 14% from 1983 and 38% from its 1982 funding of \$336 million. Over the past two years, EPA's research staff has been cut 40%.

During that time, all extramural grants and cooperative agreements in pesticide research were eliminated. In-house epidemiology work was ended. Lead and benzene regulations were relaxed. EPA development work on air and water pollution control technology was ordered stopped, along with research programs on the Great Lakes, diesel emissions, nonpoint source pollution, and nonionizing radiation.

Scientists sympathetic to environmental control were weeded out of the agency's top jobs and advisory roles. The Interagency Regulatory Liaison Groups, by which scientists in, say, the Food & Drug Administration or Department of Agriculture could compare notes with EPA's scientists on common toxic chemicals, also were dissolved. EPA pulled out its support for the National Toxicological Research Center in Pine Bluff, Ark.

But most damaging, in the view of Richard M. Dowd, policy analyst at Environmental Research & Technology Inc., was former EPA Administrator Anne Burford's undermining of scientific integrity in the agency itself. At EPA, science must be tied to regulation but almost never is. But EPA also has the responsibility for looking further ahead toward future problems, "and Burford acted as if she didn't want to hear about them," Dowd says. "Whether Ruckelshaus is successful in repairing the damage is still problematical since he will be serving the same Administration." Comments one EPA R&D staffer: "When you are dealing with politics, science takes a back seat."

In the face of all this, problems continue to mount, if not in size, then in subtlety.

"We are in the early stages of a total reorientation of what we per-

EPA's research priorities for the future

Acid rain. A comprehensive atmospheric field study to be started, dry deposit monitoring accelerated, and watershed research studies expanded. Continuing research on limestone injection, multistage burner control technology.

Hazardous waste. Postclosure monitoring of land disposal facilities, screening protocols for hazardous wastes, support for research backup for dumping permits.

Superfund research. Support for engineering activities ceases, shifts to monitoring and environmental effects research. Money for this from Hazardous Substance Response Trust Fund supported by taxes on oil and chemical industries.

Drinking water. Risk assessment, health research, monitoring. Primary

drinking water regulations still being revised.

Air. Comprehensive health risk assessments, monitoring methods for sampling and analyzing noncriteria organic pollutants, air quality dispersion models.

Water. Ocean dumping and control requirements. Innovative and alternative municipal treatment technologies, efficient sludge management techniques. Industrial wastewater research will be reduced, reflecting completion of the effluent guidelines effort, and will be refocused to support the wastewater permit program.

Toxic substances. Development of health risk assessment models. Major monitoring study completed; engineering technical support for review of chemicals completed.

ceive to be the most important environmental problems," J. Clarence Davies, executive vice president of the Conservation Foundation, declared before the House Science & Technology Committee two weeks ago, "and we do not have the scientific information needed to cope with this realization."

"Until recently," added Davies, "we thought that the effects of pollutants were limited primarily to acutely toxic effects on humans and wildlife. We now realize that chronic health effects probably are more important than acute effects and that effects may take decades or even centuries to be perceived. All of the boundaries of time, space, number of pollutants, type of effect, and media that defined environmental problems 10 years ago are no longer valid."

Research always has been an organizational nightmare at EPA. When the agency was established 12 years ago, however, the mood was upbeat. For the first time, an agency was established that could put into practice what many scientific advisory groups had been saying for years: that the environment should be seen as an entirety, unbounded by imaginary lines among the air, water, ground, and living things. With such a holistic perspective, a truly logical, scientifically based assault could be made on society's contamination of Earth.

Under Stanley M. Greenfield, former assistant administrator, research and monitoring, at EPA, a research plan was devised and an organization set up. But by 1975 the whole thing fell apart. The environment may not have boundaries, but bureaucracies do. The air, water, and ground were dubbed "media" and regulatory divisions were established with high, impermeable walls separating them. Greenfield had hoped to devise a research program based on ideas coming up from his researchers. However, EPA was mainly a regulatory agency and the ideas of scientists and the regulators they were supposed to serve never meshed.

Walls, in fact, sprang up everywhere. Communication between EPA's engineers and scientists, scientists and legal staff, and EPA sci-



Riordan: implementing the latest reorganization plan for R&D office

entists and the industries being regulated was terrible. The regulatory staff often was unaware of research at the agency that could help it in its work. The research staff was often impatient with legal fine points, the enforcers with scientific nit-picking. Scientists often declined to pursue research the regulators felt was needed. Industry scientists for

their part looked on EPA's regulators as overzealous, overpaid, mediocre boobs. And no one needed to be told with what contempt environmental scientists regarded the industrial ethic.

Things weren't going so well among the researchers, either. Laboratory directors more often competed than cooperated with one another on common projects or regulatory dilemmas. Although they needed to talk to agree on research agendas, they mostly couldn't. And so they didn't. It quickly became clear that good science would not, and probably could not, make for the kind of decisive EPA which, for different reasons, the public and industry could really trust. Research wasn't the same as monitoring, which wasn't the same as enforcement, which wasn't the same as regulation. And as for anticipating future environmental problems, EPA never made any pretense of doing that and still doesn't.

"EPA just never solved the problem of differentiating between information for regulation and information for understanding," says an environmental analyst on Capitol Hill. "The latter is easy; the former is much tougher."

Even now, EPA scientists can't say whether anyone at Love Canal physically suffered from toxic ex-

Since fiscal 1981, only acid rain research funding has increased at EPA

Research funding, \$ thousands	1981 ^a	1982 ^a	1983 ^b	1984 ^c
Air	\$ 67,494	\$ 54,402	\$ 59,380	\$ 51,191
Water quality	62,881	53,529	30,589	19,250
Drinking water	26,345	30,913	23,323	20,900
Hazardous waste	29,643	29,246	32,952	27,389
Pesticides	10,804	7,112	6,521	6,063
Radiation	3,167	2,545	1,726	233
Interdisciplinary	6,385	6,558	6,951	18,144
Toxic substances	35,518	34,148	27,206	23,769
Energy	104,939	31,348	25,001	23,530
Control technology	55,243	12,821	9,633	7,125
Health effects	15,893	2,645	2,389	2,367
Ecological effects	22,632	6,511	450	0
Monitoring systems	3,135	0	0	0
Technical information	875	178	0	0
Acid rain	7,161	9,193	12,529	14,038
Management/support	8,576	7,931	8,682	3,660
Superfund	0	13,813	6,336	6,381
TOTAL	\$355,552	\$271,543	\$223,647	\$205,510

Notes: Fiscal years. a Actual funding. b Estimate. c Funding request.

posure, a problem that isn't helped when its key office of health is run not by an epidemiologist but by a physicist from the aerospace community. And as for determining the harm to lakes and ponds caused by acid rain, scientists remain unable to agree on general principles for extrapolating measurements taken from small areas to larger regions.

As a result, EPA's R&D staff, involved with 2000 separate research projects on 60 separate issues, is deeply troubled. Although it has undergone only three reorganizations since the agency's founding, it has been reshuffled constantly in response to criticism for lacking focus and foresight.

There's no question that EPA needs help. And no one knows that more than EPA's acting R&D chief Courtney Riordan. Although his permanent job is director of the agency's Office of Monitoring Systems & Quality Assurance, Riordan has been acting director of the Office of R&D for more than a year and is in the process of implementing the latest reorganization plan for that office. The new scheme would give its laboratory directors around the country more control of research program planning and set up what appears to be a complex interplay of offices.

Lead or "master" laboratories for health, engineering, biology (or ecosystems), transport and fate of pollutants, and environmental measurement (or monitoring) would be set up. Thus, certain laboratory directors would become "superdirectors" of research and no one knows the consequences of that on morale. And the plan also would set up an office of research planning for the categories of air, noise, and radiation; water; solid waste and emergency response; pesticides and toxic substances; and technical assistance and liaison. It would form the link between EPA research and regulation. "This new plan," comments one office head, "is not only too ridiculous to understand, but it seems to set up the same kinds of problems we've been trying to get rid of."

That may be overcritical. Two years ago, EPA began establishing research committees composed of



Davies: chronic health effects are more important than acute

regulators and research administrators in Washington. The goal was to bring about that long-missing marriage between what were really two separate EPAs. The committees now number 12 and include drinking water, pesticides, particulate and gaseous air pollution, oxidants, testing and assessment, and water quality, among others.

Now the goal is to bring laboratory directors more directly into that process. And it is seen as a definite plus in an agency whose laboratories more often resemble provincial outposts than national centers. Riordan knows what the problems are and says the plan, although defensible, needs to go even further. "What's still missing is the synthesis," he says. "I think the reorganization will solve problems at the planning level. But we'll also need integration at the project level."

That could be the toughest job. Laboratory directors and scientists don't do a good job at crossing disciplines and working jointly on common projects. A chemist working on atmospheric transformations of arsenic, for example, has trouble communicating with an ecologist who wants to know how it moves through the ecosystem.

Moreover, the plan has been cooking for much too long anyway. "Any expert on organizational development will tell you that—especially in a bureaucracy—when you reor-

ganize you should do it fast. The longer it drags out, the less likely it will be accepted."

EPA's research has been criticized on many levels of logic over the years, but the criticism most common is that the agency has never made a priority of gearing research to foresee crises. "You'll see EPA respond to a crisis by buying an entire town," says a Congressional staffer who follows EPA's research, "but they don't usually do the research that would allow us to anticipate problems. And that's been true for years."

One big problem is that EPA makes scant attempt to seek data from agencies that do ecological research. For example, USDA does research on the beneficial aspects of pesticide development. One would think USDA researchers would be turning up interesting findings on the path of pesticides through the ecosystem. If they do, EPA doesn't try to find out. According to one scientist in EPA's pesticides division, there is no coordination between the two agencies. Too often the agency is forced to respond to crises like Times Beach or Love Canal. One gets the picture of an R&D office that is being jerked around so much that it loses a sense of identity.

Riordan knows that the core of the problem lies in the budget process. "There," he says, "you are forced to put priorities in areas you get yelled at for not doing. So what gets lower priority are important things like hazardous air pollutants, or indoor air pollution, or acid rain, or special chemicals like furans or PCBs, or longer-term research on basic atmospheric processes that create pollutants. So the agency doesn't get any better at developing the information base it will need for making decisions on hazardous chemicals. In sulfur dioxide particulates, decisions have been made off data that haven't changed for 20 years."

The answer? One Congressional aide says leadership obviously is needed at the White House level. There is need for a strong advocate of the R&D office. Presidential Science Adviser George A. Keyworth II, a physicist, is on record as hav-

ing scant respect for the work of environmental scientists, so he is far from the advocate EPA needs.

"Why don't people, really good people, want to take that job as head of research at EPA?" asks the aide. "It's probably because it sits too far down the peer ladder. Would you want it on your résumé that you

were head of EPA's office of research and development? I don't think it would impress anyone."

But it also makes sense to say that whoever can take over that office and give environmental research the prestige it needs will go down in science history as an administrator with the wisdom of Solomon. □

Patent office plans to automate fully by 1990

"No more paper" could well be the new slogan of the Patent & Trademark Office (PTO). It is undertaking an ambitious, multimillion-dollar effort to fully automate its operations by 1990, and Chemical Abstracts Service, a division of the American Chemical Society, may play a role in that effort.

PTO processes and examines more than 100,000 patent applications annually, comparing the applications' subject matter to a large body—24 million documents—of technological information to determine whether the inventions are new and not obvious to someone knowledgeable in that field. But because the files are all paper, problems occur. According to PTO, up to 7% of the file is missing at any time, threatening the quality of patent grants. Processing paper applications requires moving large amounts of paper frequently and matching some 20,000 pieces of mail daily with corresponding files distributed throughout PTO offices.

But the future, as PTO sees it, is electronic. That means that from the moment a patent application arrives at the patent office until a decision is made to grant or not grant a patent, every step will be handled by a computer. Examiners will do the necessary comparisons to determine if an invention is patentable at electronic work stations, using available commercial, as well as PTO's own, databases. Approved applications will be extracted automatically from the database and prepared for photocomposition and printing. Maintenance fees also will be handled through the system.

But for the system to operate, an examiner, for example, must be able to search for and retrieve the particular piece of information that is needed. As J. Howard Bryant, ad-

ministrator for automation at PTO, says, the system is software driven and that is where CAS comes in. Close to 40% of patent searches involve chemistry, and CAS has developed a system to create, store, maintain, and retrieve a large database of chemical structures and text from interactive work stations such as the PTO envisions using.

"Rather than attempt to reinvent that part of the system," Bryant explains, "what we are contemplating doing is awarding a contract for the use of [CAS] software as a base" for the PTO system. He believes that the CAS system is unique and that nobody else has anything comparable to offer. Just to make certain, PTO published an announcement of the contemplated award to CAS in the April 25 issue of *Commerce Business Daily*, making it clear that a contract with CAS would not limit contracts for other commercial databases that might be needed for patent examination.

The announcement says that anybody who does have a search and retrieval system that they think would be comparable to CAS's should notify PTO within 30 days. "If there are no offers of substance, we would propose to go forward with the contract award" to CAS, Bryant says. No cost estimate for the CAS part of the automation effort is available, but Bryant says, "We estimated that over 20 years, the systems' cost, both developmental and operational, including our personnel, would come to about \$750 million." The actual cost of getting the system up (above and beyond the benefits PTO will receive during the developmental period) is about \$25 million. But as he points out, it costs PTO \$5 million a year just to store the paper files it has now. □

Federal Alert— new regulations

This listing covers noteworthy regulations published in the Federal Register from March 28 to April 30. Page numbers refer to those issues.

PROPOSED

Drug Enforcement Agency—Raises fees as much as fivefold for registration of controlled substances by manufacturers and distributors; comments by June 6 (April 5, page 14640).

Environmental Protection Agency—Proposes and requests comments on variety of regulations to control disposal of hazardous wastes containing chlorinated dioxins, dibenzofurans, and phenols; comments by June 3 (April 4, page 14514).

Lists new emissions standards for radionuclides for variety of sources; comments by May 30 (April 6, page 15076).

Publishes semiannual agenda of expected regulatory actions (April 25, page 18468).

Federal Energy Regulatory Commission—Suggests amendments to eliminate some record-keeping regulations for natural gas and oil pipeline companies; comments by May 23 (March 28, page 12722).

Occupational Safety & Health Administration—Moves to lower eight-hour time-weighted-average exposure of workers to ethylene oxide to 1 ppm from current 50-ppm level; comments by June 17 (April 11, page 17284).

Publishes semiannual agenda of expected regulatory actions (April 25, page 18184).

FINAL

Energy Department—Establishes standard contract for disposal of spent nuclear fuel and/or high-level radioactive waste; effective April 18 (April 18, page 16590).

Environmental Protection Agency—Revises specifications and test procedures for use of continuous emissions monitoring systems to measure opacity; effective March 30 (March 30, page 13C22).

Adds additional chemicals to list of substances for which unpublished health and safety studies must be submitted under Toxic Substances Control Act; effective April 29 (March 30, page 13178).

Gives assistant administrator for pesticides and toxic substances authority to approve certain polychlorinated biphenyl disposal facilities that previously required approval of EPA regional administrator; effective April 29 (March 30, page 13181).

Nuclear Regulatory Commission—Gives power plant licensees authority to take reasonable actions that are not strictly permitted under licensing conditions in an emergency situation; effective June 1 (April 1, page 13966).